# Project-1 (Intro. To Financial Engineering)

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# Overview

- Choosing the Stock to fit the model on.
- Choosing the right Indicators
- Calculating the Indicators values at each timestamp
- The correlation Analysis of Indicators
- Choosing Weights for the Combined Indicators
- Predicting the position at each time-stamp and calculating the accuracy

# Stock

- We chose the Amazon stock ( Amazon.com, Inc. (AMZN)) and fetched the data for past 3 years.
- The Prices are NasdaqGS - NasdaqGS Real Time Price. Currency in USD
- The total no of samples are 765 which would be further split into training and testing sets

# Indicators

1. MACD
2. Moving Average
3. Relative Strength Index (RSI)
4. Bollinger Bands

## MACD

- Moving Average Convergence Divergence Indicator
- - Measures the strength and direction of a trend.
- - Consists of a fast EMA, slow EMA, and a signal line.

## Moving Average

- Used to smooth out price data and identify trends.
- SMA (Simple Moving Average) calculated over a specified window.

## Bollinger Bands

- Provides insights into volatility and potential reversal points.

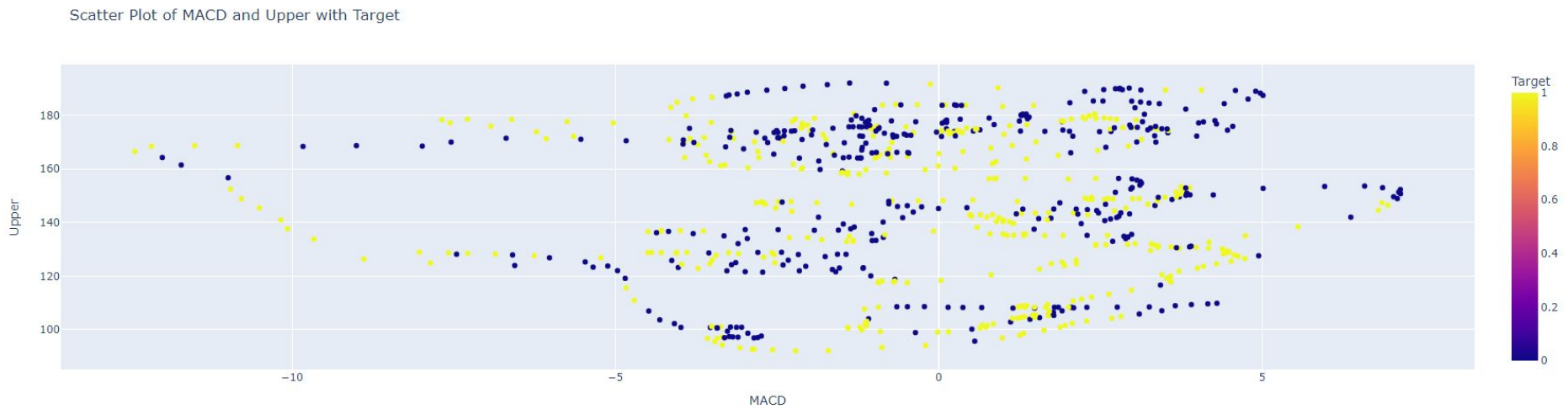
- Composed of a middle band, upper band, and lower band.

- If prices reach the upper band, the trader may consider selling

## RSI (Relative Strength Index)

- Measures the magnitude of recent price changes.

- Indicates overbought or oversold conditions.

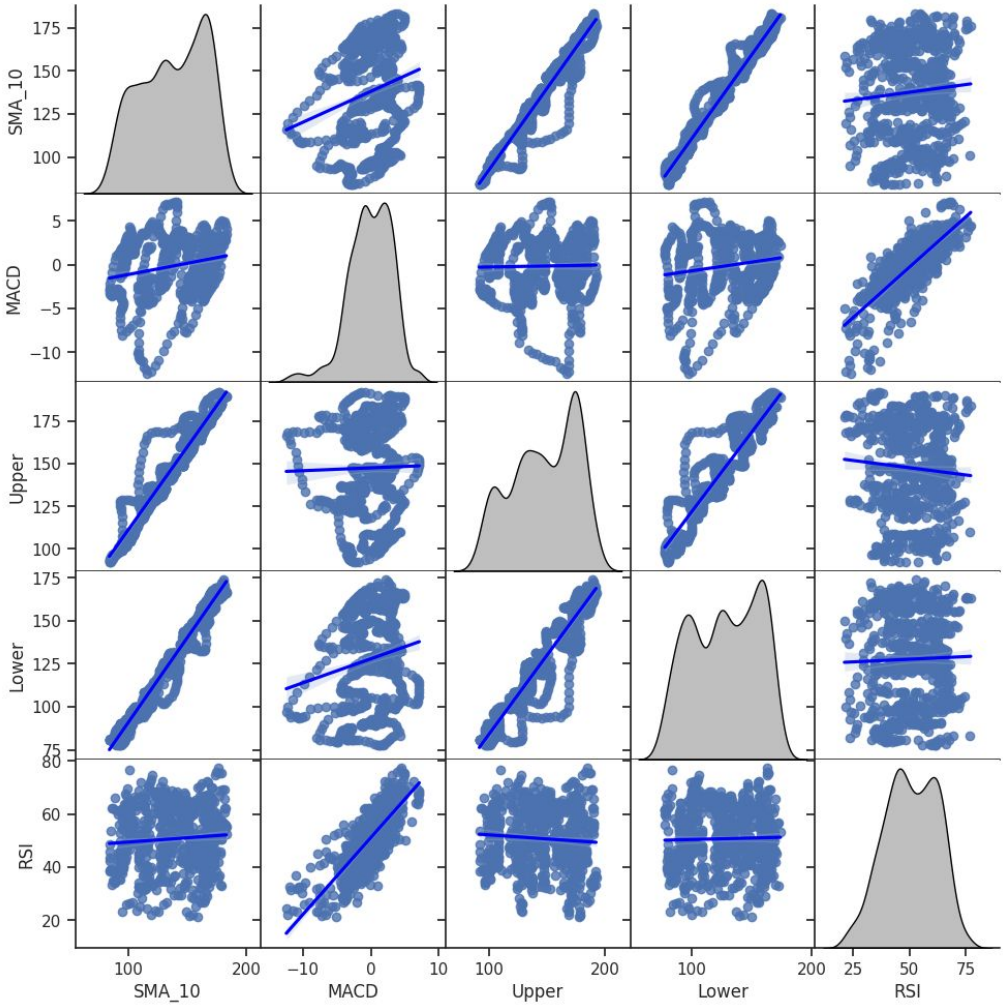

Scatter Plot of MACD and Upper with Target
Upper
180
160
140
120
100
−10
−5
0
5
MACD
Target
1
0.8
0.6
0.4
0.2
0

# Calculation of Y_actual

- To calculate the actual target values, we considered the stock prices of next 10 days.
- If the stock closing price increases the next  10 days then , the ideal position to take on this day would be to long the stock that is L
- If the stock closing price decreases the next 10 days then, the idea position to take on this day would be to short the stock that is S

# Correlation Analysis

- - Conducted correlation analysis to understand relationships between key indicators.
- - Correlation Matrix provided insights into the strength and direction of associations.
- - Visualization through pair plots helped in identifying patterns and trends.


SMA_10
MACD
Upper
Lower
RSI
175
150
125
100
5
0
−5
−10
75
80
60
40
20
−10
10
200
25
50
75

# Correlation Analysis

- First we wrote functions to calculate the Indicator values at each timestamp.
- Let us suppose that X = [I1 I2 I3 I4]  where I1 =[I11  I12  I13… ].T\
- I_ij: the value of ith Indicator at jth timestamp
- Now to calculate the weights , we need to solve the following optimization problem

$$\text{ArgMin}_w \ ||XW-y||^2$$

- But Now we can see that,  this is a Linear Regression problem

- The Analytical Solution for this regression Problem is as follows

$$w = (X^T * X)^{-1} * X^T * y$$

- Also we Know that for matrix X, the correlation matrix can be given as follows after normalizing

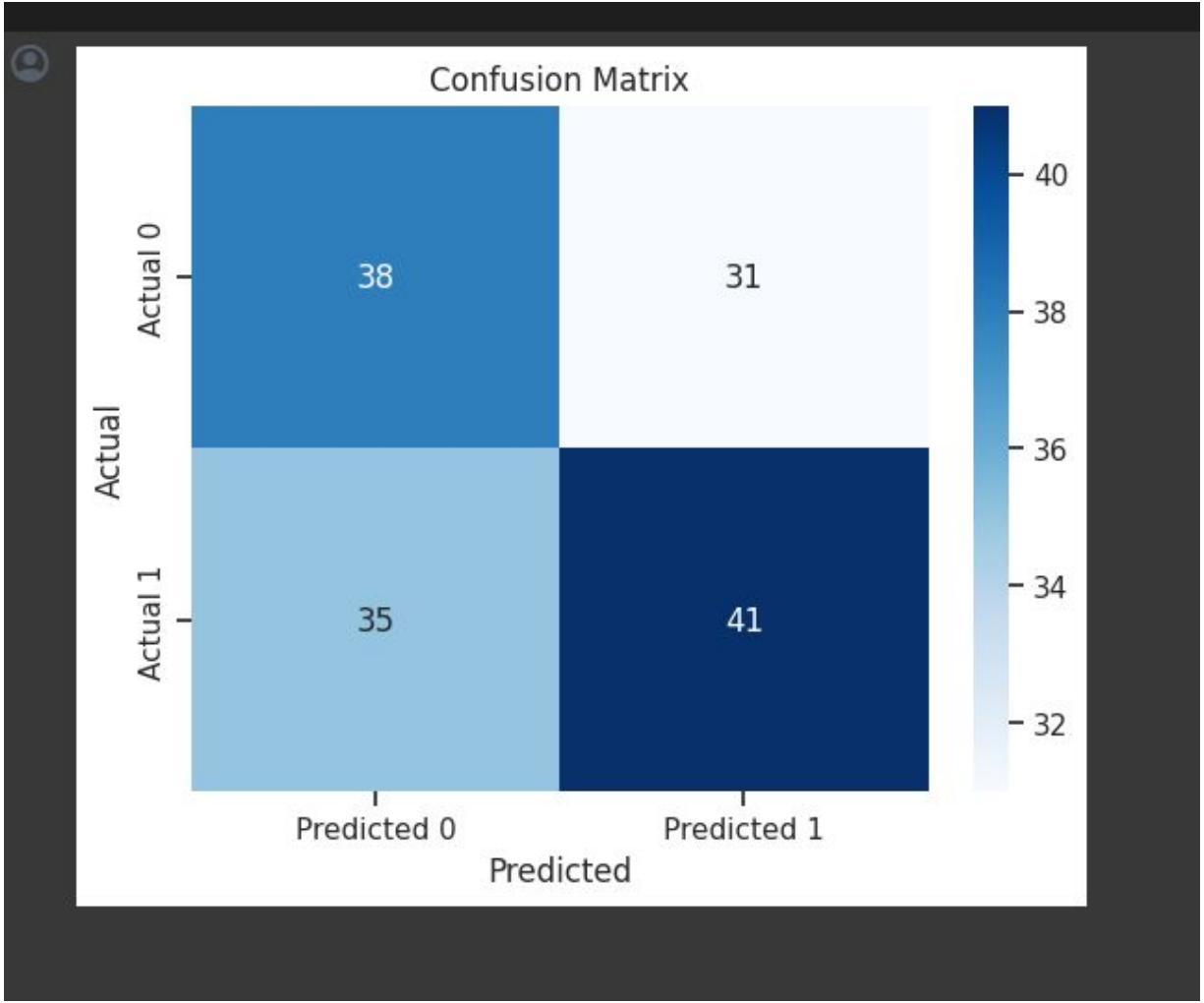
$$C = ((X - mean(X))^T * (X - mean(X))^{-1} * S^{-1}$$

- Since we normalized the data mean(X) = 0 and S is identity matrix.
- Hence, $w = (X^T * X)^{-1} * X^T * y$ is incorporating correlation between indicators.

- Now we calculated the the weights using the solution.
- Now it is time for making predictions
- Y_pred = Xw
- The predicted values will be between 0 to 1, so

  Y_pred[i]<0.5 => assign to 0

  Y_pred[i]>=0.5 => assign to 1


Confusion Matrix
Actual 0
Actual 1
Actual
38
31
35
41
Predicted 0
Predicted 1
Predicted
40
38
36
34
32

# Thank You